CLAIMS

1. A liquid crystal display comprising:

a pair of substrates, at least one of said substrates being transparent;

a liquid crystal layer disposed between said pair of substrates;

a group of electrodes formed on one of said pair of substrates for applying an electric field having a component substantially in parallel with a surface of said substrate to said liquid crystal layer;

a plurality of active devices connected to said group of electrodes;

an alignment control film disposed between said liquid crystal layer and at least one of said pair of substrate; and

optical means formed on at least one of said pair of substrates for changing the optical property of said liquid crystal layer in accordance with an alignment state of molecules of said liquid crystal layer,

wherein at least one of said alignment control films is an alignment control film comprising photoreactive polyimide and/or polyamic acid provided with an alignment control ability by irradiation of substantially linearly polarized light.

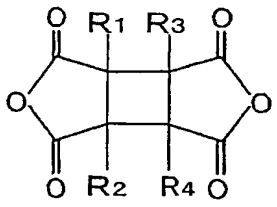
2. The liquid crystal display according to claim 1, wherein liquid crystal molecules constituting the liquid crystal layer on said alignment control film

have a long axis in a direction in parallel with or orthogonal to a polarization axis of the substantially linearly polarized light for irradiation.

3. The liquid crystal display according to claim 2, wherein said photoreactive alignment control film contains polyamic acid or polyimide comprising cyclobutanetetracarboxylic acid dianhydride and/or its derivative and aromatic diamine.

4. The liquid crystal display according to claim 2, wherein said photoreactive alignment control film is polyamic acid or polyimide containing at least 50% of a repeated structure of polyamic acid or polyimide comprising cyclobutanetetracarboxylic acid dianhydride and/or its derivative and aromatic diamine.

5. The liquid crystal display according to claim 3 or 4, wherein the cyclobutanetetracarboxylic acid dianhydride and/or its derivative is a compound represented by a formula [1]:

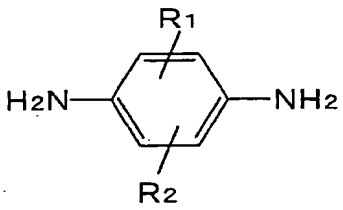


...[1]

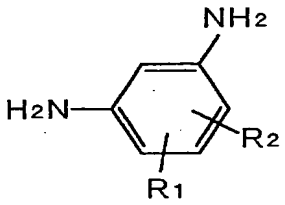
where R_1, R_2, R_3, R_4 each represent a hydrogen atom, a fluorine atom, an alkyl group or alkoxyl group with a carbon number of 1 to 6.

6. The liquid crystal display according to claim

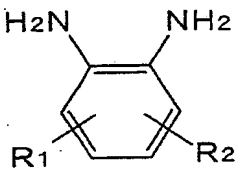
3 or 4, wherein the aromatic diamine compound contains at least one of compounds selected from a group of compounds consisting of ones represented by formulas [2] to [16]:



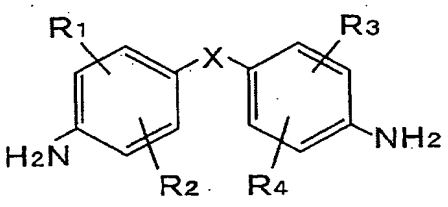
…[2]



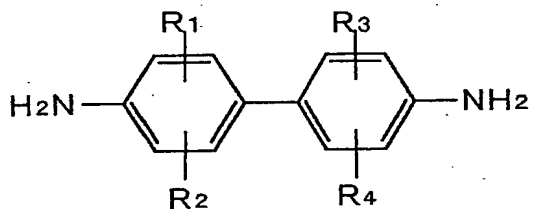
…[3]



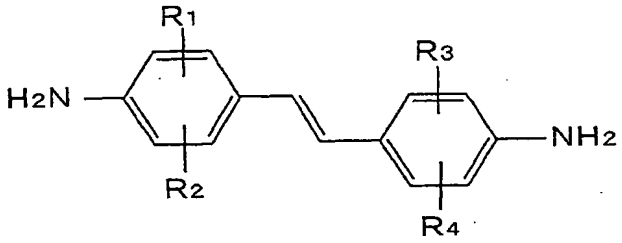
…[4]



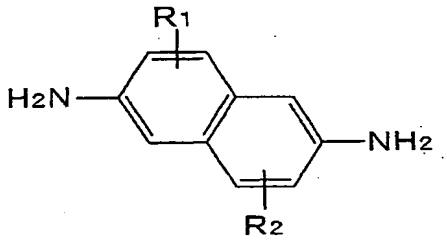
…[5]


R1
R3
H2N
NH2
R2
R4

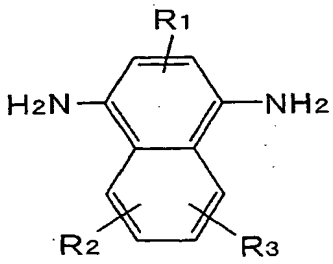
…[6]


R1
R3
H2N
NH2
R2
R4

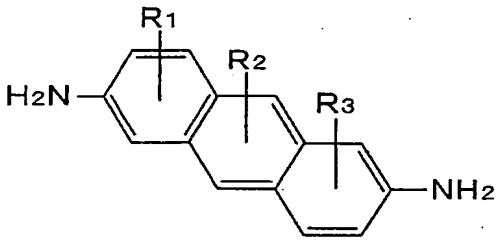
…[7]


R1
H2N
NH2
R2

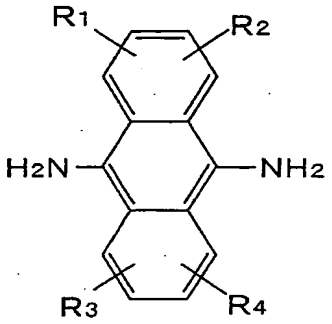
…[8]


R1
H2N
NH2
R2
R3

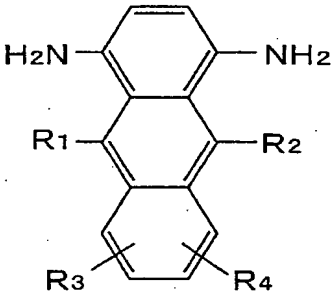
…[9]


R1
R2
R3
H2N
NH2

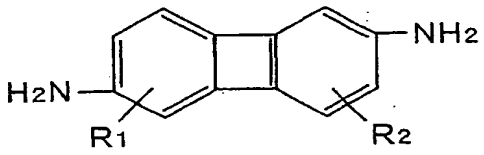
…[10]


R1
R2
H2N
NH2
R3
R4

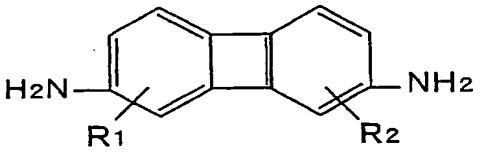
…[11]


H2N
NH2
R1
R2
R3
R4

…[12]


NH2
H2N
R1
R2

…[13]



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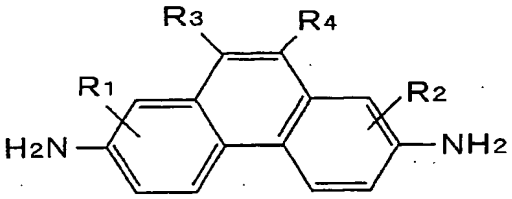
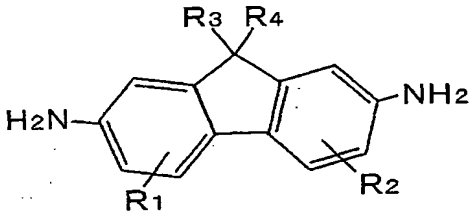


···[15]



···[16]

where R_1, R_2, R_3, R_4 each represent a hydrogen atom, a fluorine atom, an alkyl group or alkoxyl group with a carbon number of 1 to 6, or a vinyl group {$-(CH_2)_m-CH=CH_2$, m=0,1,2} or an acetyl group {$-(CH_2)_n-C\equiv CH$, n=0,1,2}, and in the formula [5], X represents a bond group -S-, -CO-, -NH-.

7. The liquid crystal display according to any one of claims 1 to 6, wherein said alignment control film comprising the polyimide material has a thickness from 1 nm to 100 nm.

8. The liquid crystal display according to any one of claims 1 to 6, wherein said alignment control

film has a thickness from 1 nm to 50 nm above the electrodes constituting said group of electrodes.

9. The liquid crystal display according to any one of claims 1 to 5, wherein said alignment control film has a thickness from 1 nm to 30 nm above the electrodes constituting said group of electrodes.

10. The liquid crystal display according to any one of claims 1 to 9, wherein the alignment control film has a glass transition temperature equal to or higher than 250°C.

11. The liquid crystal display according to any one of claims 1 to 10, wherein said liquid crystal layer has a pretilt angle equal to or smaller than one degree.

12. The liquid crystal display according to any one of claims 1 to 11, wherein said group of electrodes has a pixel electrode and a common electrode, and at least one of the pixel electrode and the common electrode is formed of a transparent electrode.

13. The liquid crystal display according to claim 12, wherein the transparent electrode is formed of an ion-doped titanium oxide film or an ion-doped zinc oxide film.

14. The liquid crystal display according to any one of claims 1 to 13, wherein the common electrode or a wire for the common electrode or a wire for a signal is made of Al, Cr, Mo, Ta, W or an alloy containing any one of them.

15. The liquid crystal display according to any one of claims 1 to 14, wherein the pixel electrode and the common electrode opposite thereto are disposed in parallel with each other and each have a bending structure.

16. The liquid crystal display according to any one of claims 1 to 15, wherein the common electrode and/or the pixel electrode is formed on an organic insulating film, and said liquid crystal alignment film is formed on the organic insulating film and the group of electrodes.

17. The liquid crystal display according to any one of claims 1 to 16, wherein said liquid crystal molecules have substantially the same alignment control directions at two interfaces between said liquid crystal layer and said alignment control film formed on each of said paired substrates.

18. A method of producing a liquid crystal display,

wherein the liquid crystal display has a group of electrodes for applying an electric field having a component substantially in parallel with a surface of one substrate and a plurality of active devices connected to the group of electrodes, and the method comprises the steps of:

sandwiching a liquid crystal layer between a pair of substrates, at least one of the substrates being transparent; and

disposing an alignment control film between the liquid crystal layer and at least one of the pair of substrates, the alignment control film comprising photoreactive polyimide and/or polyamic acid provide provided with an alignment control ability by irradiation of substantially linearly polarized light;

the liquid crystal display having optical means formed on at least one of the pair of substrates for changing the optical property of the liquid crystal layer in accordance with an alignment state of molecules of the liquid crystal layer,

wherein the polarized light for irradiation of the liquid crystal alignment control film has a wavelength range from 200 nm to 400 nm.

19. The method of producing a liquid crystal display according to claim 18, wherein the alignment processing for providing the liquid crystal alignment ability for the liquid crystal alignment film comprises a processing of polarized light irradiation with at least two wavelengths, that is, substantially linearly polarized light with a first wavelength and a second wavelength.

20. The method of producing a liquid crystal display according to claim 18 or 19, wherein the alignment processing for providing the liquid crystal alignment ability for the liquid crystal alignment film comprises a processing of polarized light irradiation with at least two wavelengths, that is, substantially

linearly polarized light with a first wavelength and a second wavelength, and in addition, a secondary processing including at least one of heating, irradiation of infrared rays, irradiation of far infrared rays, irradiation of electron beams, and radiation of radioactive rays.

21. The method of producing a liquid crystal display according to claim 20, wherein the processing of the polarized light irradiation is performed to overlap in time with the secondary processing.

22. The method of producing a liquid crystal display according to claim 20 or 21, wherein the secondary processing also serves as an imidation calcination processing of the liquid crystal alignment film.

23. The method of producing a liquid crystal display according to claim 20 or 21, wherein the alignment control film is set to a temperature in a range from 100 to 400°C when the secondary processing is performed.

24. The method of producing a liquid crystal display according to claim 20 or 21, wherein the alignment control film is set to a temperature in a range from 150 to 300°C when the secondary processing is performed.